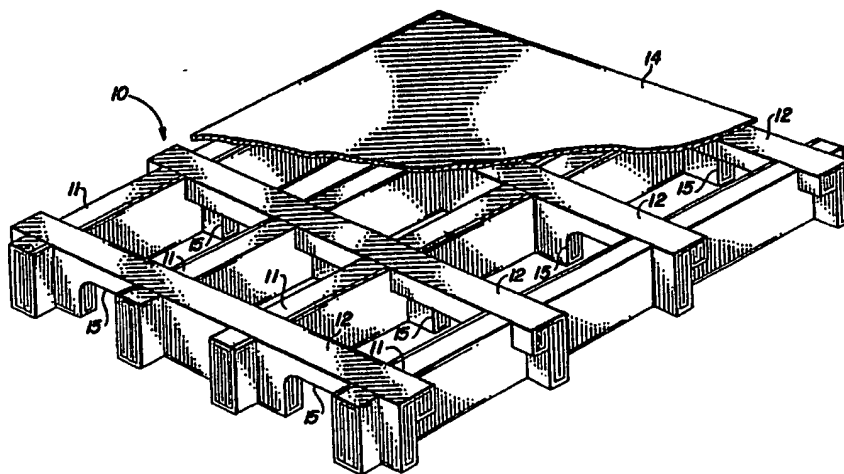




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<b>(21) International Application Number:</b> PCT/US92/09928 <b>(22) International Filing Date:</b> 12 November 1992 (12.11.92)  <b>(30) Priority data:</b> 792,182                      14 November 1991 (14.11.91) US  <b>(71) Applicant:</b> CORRUGATED PALLET CORPORATION [US/US]; 2646 Lasso Lane, Lakeland, FL 33801 (US).  <b>(72) Inventors:</b> WINEBARGER, Ken, N. ; 2007 Woodbriar Loop, South, Lakeland, FL 33813 (US). LEE, Stanley, M. ; 12510 Exbury Court, Tomball, TX 77375 (US).  <b>(74) Agent:</b> DOLGORUKOV, D., Edward; Marshall & Mel- horn, Four SeaGate, Eighth Floor, Toledo, OH 43604 (US).		<b>(81) Designated States:</b> AU, BR, CA, CS, FI, HU, JP, KP, KR, NO, PL, RO, RU, SD, UA, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>With amended claims.</i>

**(54) Title:** CORRUGATED PALLET**(57) Abstract**

A pallet (10) of corrugated fiberboard material has floor-contacting spaced, parallel and longitudinal extending base members (11) perpendicularly interconnected at longitudinally spaced intervals by spaced, parallel and laterally extending deck members (12). Each member is constructed from creased and scored rectangular blanks (21) folded to comprise a solid core of adjacent vertically oriented panels (22) surrounded by an outer covering of perimetric horizontal and vertically running panels.

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## CORRUGATED PALLET

This is a continuation-in-part of U.S. patent application Serial No. 07/631,714, filed June 24, 1991, which is a continuation of copending U.S. patent  
5 application Serial No. 07/321,022, filed March 9, 1989 (now U.S. Patent No. 4,979,446).

## BACKGROUND OF THE INVENTION

This invention relates in general to a pallet of corrugated material; and, more specifically, to a  
10 corrugated pallet having superior strength and break resistance.

Pallets are widely used in the transportation and storage of goods. The goods (typically packaged in boxes or bags) are stacked on the pallet and bound thereto by  
15 straps or wrapping for shipment therewith as an integral unit. Loaded pallets are stored in warehouses either on the floor or in racks in adjacent single or multiple level layers.

Conventional pallets are usually made of wood.  
20 Wooden pallets offer good materials handling and stacking strength characteristics. The decreasing supply of readily available wood is raising the cost of such pallets, however, and such wooden pallets are heavy and bulky to transport.

25 The use of pallets made of corrugated paperboard and similar materials as a substitute for wooden pallets has gained limited acceptance for some applications. Such corrugated pallets are lightweight, relatively maintenance free and readily disposable or recyclable. They may be  
30 transported and stored in unassembled form for maximum space utilization when unloaded, and assembled on-site for loading. After usage, they can be broken down for disposal or recycling just like cardboard boxes and other corrugated products.

One kind of known corrugated pallet is illustrated by the structures shown in U.S. Patent Nos. 2,466,914; 2,728,545; 3,464,371; and 3,477,395. Such pallets comprise a plurality of longitudinally extending elongated base members or stringers held in parallel, spaced relation by means of top and bottom rectangular decking sheets to form skids with open channels into which the tines of forklifts can be inserted for materials handling purposes. Other versions of such pallets, as shown in U.S. Patent Nos. 3,131,856 and 3,683,822, add a degree of lateral stability by providing a plurality of laterally extending, parallel, spaced deck members or cross runners perpendicularly interconnecting the base members at axially spaced intervals to form a rectangular lattice structure. The deck members span the base members in elevated positions without floor contact between the base members leaving the fork channels unobstructed.

Though known corrugated pallets provide lightweight, inexpensive alternatives to conventional wooden pallets for some applications, their strength and rigidity under both static and dynamic loading is insufficient to permit widespread general usage for all types and distributions of goods. Base member constructions, such as shown in the '371 and '395 patents having wrapped, adjacent side-by-side thicknesses of fluted fiberboard material placed in vertical direction of corrugation, are not known to have been employed in criss-cross lattice type pallet structures such as shown in the '656 and '822 patents. Rather, the latter type corrugated pallets having perpendicularly interconnecting base and deck members have generally been formed from weak, relatively open core, support members. The skid type structures have no lateral support members at all; and the lateral members of the lattice type structures do not contact the floor between

longitudinal members, so provide only suspension lateral weight supporting capabilities. Structures, such as the lattice shown in the '822 patent, are moreover prone to rocking instability, with the elevated cross ties being  
5 able to pivot out of the base members under dynamic loading.

No known self-supporting pallet structures make adequate accommodation for four-way forklift tine entry into the pallet. The skid types represented by the '914,  
10 '545, '371 and '395 pallets, provide only two-way, front and rear entry into the spaces between the base members formed by the top and bottom sheets. The lattice types represented by the '656 and '822 patents provide the same two-way entry between the base members in the area below  
15 the deck members and, in addition, provide optional four-way access by means of cutouts or "pockets" made at floor level in the deck member (see, e.g., the pallets of Corpall Systems, Inc., Jacksonville, Florida). Four-way entry is also provided in related but contained non-freestanding  
20 structures, such as shown in the U.S. Patent No. 3,666,165. However, such inherently weak, open core member structures lack strength at critical points and are subject to ripping at cuts made for fork tine insertion if the carried goods exceed the weight of cushions, textiles  
25 and similar light loads.

The strongest known corrugated pallets today have a load rating for a 4' x 4' pallet of only 6,000-8,000 pounds under static loading. Such figures are only for careful uniform stacking of concrete blocks, however, and  
30 only for two-way addressable pallets. Under actual road transportation and warehouse stacking conditions, the strength of such pallets is considerably less. And, adding cutouts for four-way fork tine entry reduces the maximum strength load-carrying capability further.

## SUMMARY OF THE INVENTION

It is an object of the present invention to provide a corrugated pallet having superior strength and break resistance under both static and dynamic loading.

5 In one aspect of the invention, a pallet is provided having a plurality of spaced parallel and longitudinally extending base members interconnected by a plurality of spaced parallel and laterally extending, floor contacting deck members to form a superior weight-supporting, freestanding lattice structure. In another aspect of the invention, a pallet is provided giving two- or four-way fork tine access through strengthened floor contacting members having cutouts backed up by unbroken elevated portions of the same. In a further aspect of the invention, a pallet is provided as an inexpensive skid having interlocking base and deck members of similar construction, the base members being oriented vertically and the deck members horizontally.

20 In a preferred embodiment, described in detail below, a corrugated pallet is formed from base and deck members each having a solid core of adjacent vertically oriented panels surrounded by an unbroken outer cover of perimetrically running panels. Each member is formed from a single, rectangular blank of corrugated material divided into adjacent rectangular panels which are folded along crease and score lines laid perpendicular to the direction of corrugation. Tests conducted using concrete blocks have shown that a pallet in accordance with the invention is approximately three to four times stronger than same sized corrugated pallets such as those disclosed in U.S. Patent No. 3,683,822. The members are configured to provide tine admitting openings and unbroken horizontal panel surfaces in alignment with horizontally disposed tops of the openings. The resulting structure provides

good weight-supporting and materials handling capabilities with tested weight stacking capability and break resistance approaching that of pallets made from soft wood.

5

#### BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention have been chosen for purposes of illustration and description, and are shown in the accompanying drawings, wherein:

FIG. 1 is a perspective view, partially cut away, of  
10 a corrugated pallet in accordance with the present invention;

FIG. 2 is an enlarged fragmentary perspective view of a base member and a deck member of the pallet of FIG. 1, showing their manner of interlocking;

15 FIG. 3 is a perspective view showing the underside of the deck member of FIG. 2;

FIG. 4 is a front plan view of a blank suitable for forming the deck member of FIGS. 1-3;

20 FIG. 5 is a front plan view of a blank suitable for forming the base member of FIGS. 1-3;

FIG. 6 is a view as in FIG. 1 of a modified form of the embodiment of FIG. 1;

FIG. 7 is a perspective view showing the underside of a base member of the modified structure of FIG. 6;

25 FIG. 8 is a front plan view of a blank suitable for forming the base member of FIGS. 6 and 7;

FIG. 9 is a view as in FIG. 1 of a further modified form of the embodiment of FIG. 1;

30 FIG. 10 is a view as in FIG. 2, showing the manner of interlocking of a base member, a deck member and a gusset of the further modified structure of FIG. 9;

FIG. 11 is a front plan view of a blank suitable for forming the deck member of FIGS. 9 and 10;

FIG. 12 is a front plan view of a blank suitable for forming the base member of FIGS. 9 and 10;

FIG. 13 is a view as in FIG. 1 of a second embodiment of corrugated pallet in accordance with the invention;

5        FIG. 14 is a view as in FIG. 2, showing the manner of interlocking of a base member and a deck member of the pallet of FIG. 13; and

FIG. 15 is a front plan view of a blank suitable for forming the deck member of FIGS. 13 and 14.

10        Throughout the drawings, like elements are referred to by like numerals.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. 1, an embodiment 10 of a pallet in accordance with the present invention comprises a  
15        plurality of elongated base members or stringers 11 laid in parallel, spaced positions longitudinally of the pallet 10 and interconnected in criss-cross fashion to form a freestanding weight-supporting lattice structure by a plurality of elongated deck members or cross runners 12  
20        laid in parallel, spaced positions laterally of the pallet 10 to respectively perpendicularly intersect the members 11 at axially displaced positions therealong. The shown embodiment 10 utilizes four base members 11 and four decking members 12, though it is, of course, possible to  
25        utilize a fewer or greater number of such members, if desired.

The top surfaces of the members 11 and 12 are located in a common horizontal plane to provide a level upper platform for stacking goods (not shown) thereon. An  
30        optional top sheet or deck 14 (shown in cutaway) may be applied to the top surfaces to cover the interstices of the underlying lattice framework. The bottom surfaces of the members 11 and 12 are likewise coplanar to provide a stable, floor-contacting base for the pallet 10. The



lateral members 12 are each provided with aligned cutouts 15 to provide longitudinal channels between the floor and the pallet structure 10 for two-way (front or rear) access thereinto for pallet lifting purposes by the tines of a  
5 forklift or like materials handling apparatus.

The members 11 and 12 and the top sheet 14 are all constructed of corrugated paperboard, plastic, or similar material. As shown in FIGS. 2-5, each member has a solid core of adjacent vertically stacked rectangular panels  
10 oriented with their corrugations running vertically and an outer covering or sheath of perimetrically placed rectangular panels of the same material alternately running horizontally and vertically around the core panels. The members 11 and 12 are unbroken except at  
15 their points of intersection and at the forklift tine cutouts 15.

The members 11 and 12 are interconnected at their points of intersection by locking and linking joints, in which a protuberance or void of one member mates in close  
20 tolerance relationship with a complementary protuberance or void of an intersected member. The joints should impart sufficient rigidity to the intersection to maintain a fixed relationship between them under longitudinal, lateral and axial rotational forces to be experienced  
25 during normal loaded pallet handling.

A preferred means of interconnecting members 11 and 12 is shown in FIG. 2. Members 11 are provided with upwardly-facing U-shaped rectangular notches 16 having spaced vertical walls ascending from opposite edges of an  
30 interior horizontal wall. Members 12 are provided with similar downwardly-facing U-shaped notches 17. The notches 16 and 17 are oriented perpendicularly to the elongation of the respective members 11 and 12, with the width (distance between opposite walls) of notches 16

being slightly less than the width (dimension perpendicular to the elongation) of the opposing member 12, and the width of notches 17 being slightly less than the width of the opposing member 11. To provide the level  
5 top and bottom surfaces, the vertical dimensions of the longitudinal members 11 and lateral members 12 are made equal, and the depths (vertical dimensions) of the cuts 16 and 17 are selected so that the interior horizontal wall of the notch 17 is at the same elevation as the top  
10 (lifting) surface of the cutout 15 and sum of the depths of the notches 16 and 17 is equal to the vertical dimension of each member 11, 12.

As shown in FIGS. 2-4, each of the deck members 12 has a first rectangular cross-section portion 18 extending  
15 the full height (vertical dimension) of the pallet 10 and a second rectangular portion 19 flush with the top of the pallet 10 but extending only partway to floor level. The rectangular cutouts 15 and notches 17 extend only through the first portion 18 of the member 12 from floor level to  
20 a height which is flush with the bottom of an unbroken bottom panel of the second portion 19. This arrangement is best seen in FIG. 3 which shows the underside of the member 12. The purpose of such configuration is to provide an unbroken surface 20 on the portion 19 against  
25 which tines passing through the cutouts 15 can be brought. A portion of the horizontal wall of the notches 16 which is brought up through the notches 17 will also abut the surface 20. It has been observed that this unbroken surface backup feature greatly reduces breakage, such as  
30 the diagonal tearing at the inside corners of cutouts 15 that can occur when the pallet 10 is subjected to tine lifting under heavy loading. The same also resists ripping and distortion of the panel 10 in the are of the

cutouts 15 when strapping is run therethrough for bundling goods on the pallet 10.

FIG. 4 shows a sheet or blank 21 or corrugated material suitable for use in forming the deck members 12 of the pallet 10. The blank 21 is arranged with the corrugations running from left to right perpendicular to the right- and left-hand edges of the sheet. The blank 21 is divided into adjacent parallel rectangular panels 22 (22a-22i), as shown, by crease lines 23 (dashed lines) and score lines 24 (solid lines) normal to the direction of corrugation. The crease and score lines may be created by die cutting or sawing partway through the material, with crease and score line cuts being done on opposite faces of the blank 21. To create the member 12, the blank 21 is folded, bringing adjacent panel front faces toward each other about crease lines 23 and taking them away from each other about score lines 24. The cutouts 15 and 17 are made as by die cuts in panels 22a-22e, as shown, to be properly positioned in the folded member 12.

The panels 22a-22e of portion 18 and 22g-22i of portion 19 are separately folded onto the panel 22f, so that the end panels 22a and 22i are each interiorly placed in the core sections of their respective portions 18 and 19 in the finished structure. The fixed relationship of the panels is secured in known ways, such as by gluing or stapling. The finished member 12 comprises a closely packed core of adjacent vertically stacked panels 22a-b, 22c (upper portion) and 22i-22j surrounded by an outer covering or wrap of perimetrically placed panels 22c (lower portion), 22d, 22e, 22f, 22g and 22h. Panels 22a-c, 22e, 22g, and 22i-22j all have their corrugations oriented in the vertical direction to provide the greatest downward load bearing strength to the assembled pallet 10. Only panels 22d, 22f and 22h are horizontally oriented,

and only one of those panels (i.e., panel 22d which serves as the floor contacting bottom surface) is cut to establish the tine cutouts 15 and the joint notches 17. (Though the preferred cutouts 15 are open to the floor because the tines are often lowered to scrape along the floor prior to lifting, it will be appreciated that cutting of the panel 22d at the locations of cutouts 15 is not a requirement.) For the vertical panels, transverse cutting of the fluting occurs only in the panels 22a, 22b, 22c and 22e. The panels 22g and 22f-22i remain intact. The horizontal panel 22h provides the unbroken surface to give integrity for backing up the lifting portions of the cutouts 15 and 17. The unbroken horizontal panel 22f provides the top surface or deck for stacking the goods. It is noted that horizontal surface 22d of each lateral member 12 will contact the floor providing vertical weight support to the deck at all locations, except the cutouts 15 and notches 17.

The base member 11 is suitably formed from a planar blank by folding similar to that described above for folding the blank 21 to create member 12, except there are no fork tine cutouts. With reference to FIG. 5, a rectangular blank 26 for member 11 has corrugations running from left to right, parallel with the upper and lower edges of the blank, but perpendicular to crease and score lines 27, 28 shown, respectively, by dashed and solid lines, which divide the blank 26 into adjacent rectangular panels 29 (29a-29i). Cutouts 16 are die cut or otherwise formed in the blank 26, as indicated, to provide their proper location in the folded member. Folding is begun from the panel 29i end, bringing adjacent panels faces toward each other at crease lines 27 and away from each other at score lines 28. The finished folded structure 11 (see FIG. 2) has a closely packed core of

adjacent vertically stacked panels 29e-29i wrapped by an outer covering of perimetrically placed, alternating vertically and horizontally disposed panels 28a-29d. All panels 29, except panels 29b and 29d, have their  
5 corrugations oriented in the vertical direction for greatest weight-supporting capacity.

The illustrated creasing and scoring arrangement enables the longitudinally extending, exposed fluting right edge of the right end panel 29i to be located  
10 interiorly of the folded member 11. Except for the upper and lower edges of the blank 26 which form the end of the elongated member 11 in the folded structure, exposed fluting thus occurs only at the left edge of the left end panel 29a and the cutout portions of the panels 29a, 29c-  
15 29i which form the notches 16.

In the assembled pallet 10, all exposed fluting of member 11 is concealed, except the left edge of panel 29a. For the member 12, all exposed fluting, except at cutouts  
15, will be concealed. The dimensioning of the notches  
20 16, 17 of the members 11 and 12 provides a tight interlock between the members 11 and 12 which can be performed on-site, just before pallet use, and reinforced by gluing or other common joint securing techniques.

The embodiment 10 of pallet shown in FIGS. 1-5  
25 constitutes a two-way entry version of corrugated pallet with the aligned cutouts 15 on the member 12 providing a pair of parallel channels extending longitudinally through the pallet and providing both front and rear access to apply forklift tines for lifting the loaded pallet. The  
30 unbroken horizontal panels 22h of the members 12 provide integral lifting surfaces 20 flush with the horizontally disposed interior wall of the cutouts 15 against which the tines act during lifting. These surfaces back up the exposed fluting parts of the cutouts 15 to increase the

resistance of the pallet 10 to breakage and tearing by the tines.

A modified form 10' of the embodiment 10 of the pallet in accordance with the invention is shown in FIG.

- 5 6. Pallet 10' has a modified base member 11' which gives the pallet a four-way tine access capability.

FIGS. 7 and 8 are views showing the particulars of the construction of modified base member 11'. It will be seen that the longitudinal member 12' is constructed in a two portion manner similar to the already described construction of base member 11 shown in FIGS. 3 and 4. A rectangular blank of corrugated material 36 (FIG. 8) having corrugations running from left to right is divided by creasing and scoring lines 37, 38 (as with the previously discussed blanks 21 and 26) into adjacent parallel rectangular panels 39 (39a-39i) which are folded toward each other on crease lines and away from each other on score lines to produce the folded and glued structure shown in FIG. 7.

- 20 In contrast to the base member 11 of FIGS. 1, 2 and 5, the base member 11' is provided with a series of cutouts 35 to form laterally aligned tine receiving openings in the lattice of pallet 10', as shown in FIG. 6. Panels 39a-39i are folded along the indicated lines to produce a longitudinal member having adjacent rectangular portions 40, 41, with the portion 40 being formed from panels 39a and 39b and, like the portion 19 of member 12, being uninterrupted at the tine channel cutout 35. The blank 36 is separately folded either simultaneously or sequentially from the panel 39a end and the 39j end to produce the portion 40 from panels 39a and 39b and the portion 41 from the panels 39d-39i. Both the left and right exposed fluting edges of the blank 36 (i.e., the left edge of panel 39a and the right edge of panel 39j)

are folded interiorly so that fluting is exposed only at the cutouts 35 and notches 17.

The panels 39a, 39f (upper portion), and 39g-39i make up the core of the member 11'; while the panels 39b-39e and 39f (lower portion) make up the outer wrap. All, except panels 39c and 39e, are vertically oriented with their corrugations running in the vertical direction for greatest strength. A rectangular section 42 intermediate a double fold line 37 between panels 39a and 39b provides an unbroken platform flush with the inside horizontal wall of the cutout 35 to provide backup support to the member 11' by increasing the integrity of the structure adjacent the tine-receiving slot in the same way that surface 20 provides a platform to cooperate with the tine-receiving cutout 15.

In the illustrated embodiment of pallet 10', the depth (vertical dimension) of the cutout 35 is less than the depth of the cutout 15. This is to maximize pallet access under normal conditions while minimizing the cutout areas on the longitudinal members. The cutouts 15 are made deeper to accommodate the higher floor-to-tine separation of heavy duty forklift equipment used at loading/unloading docks. Two-way, front/rear access will normally be sufficient for such high volume, fully-loaded pallet moving chores. The cutouts 35 are, however, sufficiently deep to provide four-way access to accommodate the lower elevation tines of less rugged, pneumatic tine lift trolleys that are frequently used to shift pallets around on a low volume, pallet-by-pallet basis during warehousing and for movement of inventory. The smaller depth of cutout 35 and lesser two-ply width of the unbroken section 42 (relative to the five-ply width of surface 20 of panel 22h) is considered sufficient for this purpose.

Pallets produced in accordance with the above embodiments have withstood testing in excess of 10,000 pounds under both static and dynamic loading. In one example test, a 4' x 4' pallet of the two-way entry type shown in FIG. 1, was tested to determine its performance under load, under conditions simulating a cross country journey in a truck trailer. The tester had a table which had a 1" throw and a 1" drop. Based on the amount of load, the tester was set at a speed and ran for a given period of time to simulate a trip of some specified miles.

The tested pallet was constructed of dual arch, "a" width, normal double walled BC flute corrugated paperboard, without a top sheet. The pallet was tested for 50 minutes supporting 2,520 pounds at 180 RPM's. This simulated a trip of about 5,000 miles under most difficult road conditions, during which the pallet was exposed to fore, aft and sideways swaying motions. The pallet in accordance with the invention not only survived, but appeared to be like new - never used - at the end of the test. Only a wooden pallet with bottom slats could have survived the test as well. All known corrugated pallets would have fared very poorly or failed altogether under the same test.

In accordance with the invention, a superior strength pallet has been described by reference to preferred embodiments thereof, having particular advantages over corrugated pallets of the prior art, yet providing the same advantages of lighter weight and less cost than wood pallets. The stable configuration of the pallet allows for part of the pallet to experience damage without destroying the integrity and usability of the remaining portion. The pallet provides strong floor contacting, lateral weight-supporting members with minimal flute



exposure, and structural reinforcement of all time receiving openings.

Due to the unique design of the longitudinal and lateral members, a pallet in accordance with the invention can support a load while in a rack far in excess of conventional corrugated pallets. The design of the pallet provides for more supporting members to contact either the floor or the top of an underlying pallet load. This ensures greater weight distribution and, for stacked pallets, significantly reduces crushing or creasing of the load (in most instances boxes) of underlying pallets. Because the base and deck members support the load through contact with the floor in both the longitudinal and lateral members, the pallet in accordance with the invention can transverse most roller conveyor systems in any direction. Prior art pallets which have only longitudinal floor support are limited to movement in only one direction since the rollers must generally be oriented perpendicularly to the main supporting member in order to roll the pallet.

The pallet design provides for the ability of the pallet to absorb and withstand motion shock in all directions. By providing for interlocking members and having all supporting members contacting the floor, this pallet will not collapse because of any side motion pressure. Prior art pallets do not have this ability and are thus subject to failure when sued to transport loads by truck or rail over long distances. The four-way entry version provides four-way entry while maintaining superior strength and break resistance not available in similar prior art constructions. User different size and strength requirements can be met without the need to vary the overall design. Changes in dimensions, weight and type of corrugated material utilized, etc., will not interfere

with the basic performance characteristics. This is not the case for prior art units.

A further modified form 10" of the embodiment 10 of the pallet in accordance with the invention is shown in  
5 FIG. 9. Pallet 10" has base members or stringers 11", similar to base members 11 of pallet 10. The deck members or cross-stringers 12" of pallet 10" are, however, of two-piece construction, rather than of a single-piece construction like that of deck members 12.

10 As shown in FIG. 10, each deck member 12" comprises a laterally-extending, square cross-sectioned runner 46 (corresponding to the portion 19 of member 12) and a plurality of aligned, laterally-spaced gussets or braces 47 (corresponding to the portion 18 of member 12). The  
15 runners 46 are laid in parallel, spaced positions laterally of the pallet 10" to respectively perpendicularly intersect the members 11" at axially displaced positions therealong. The gussets 47 are positioned adjacent the runners 46 for reinforcement  
20 thereof, at the points of intersection of the runners 46 with the base members 11". The number of base members 11" and deck members 12" can be varied to suit individual requirements. The shown embodiment 10" utilizes three base members 11" and three combination decking members  
25 12". Additional runners 46, without gussets 47, can be added between the combination members 12", as shown, for added stability and to fill out the common plane of the upper platform. The upper deck of pallet 10" may be covered by an optional top sheet or deck 14, described  
30 above.

The runners 46 may be formed from a sheet or blank 49 (FIG. 11), in the same way that the portion 19 of member 12 is formed from blank 21 (FIG. 4). The blank 49 is arranged with corrugations running from left to right, and

is divided into adjacent parallel rectangular panels 50 (50a-50n), as shown, by fold lines 51 (dashed lines) and score lines 52 (solid lines) which extend normal to the direction of the corrugations. The base members 11" may  
5 be formed from a blank 26" (FIG. 12) similar to the blank 26 (FIG. 5) used to form the deck members 11. The blank 26" is arranged with corrugations running from left to right, and is divided into adjacent parallel rectangular panels 29" (29a"-29i"), as shown, by crease lines 27" (dashed lines) and score lines 28" (solid lines). Cutouts  
10 16" are die cut or otherwise formed in the blank 26", as indicated. The cutouts 16a" correspond to the cutouts 16 in the blank 26 (FIG. 5), and form the notches 16" of the folded member 11" (FIG. 10) into which the combination  
15 deck members 12" are fitted. The cutouts 16b" form the intermediate notches between the notches 16a", into which the singular runners 46 are fitted.

The illustrated base members 11" have the same general cross-sectional configuration and folding pattern  
20 as the members 11. The finished folded structure 11" has a closely packed core of adjacent vertically stacked panels 29e"-29i" wrapped by an outer covering of perimetrically placed, alternating vertically and horizontally disposed panels 29a"-29d". All panels 29",  
25 except panels 29b" and 29d", have their corrugations oriented in the vertical direction for greatest weight-supporting capacity. Similarly, the finished folded structure 46 has a closely packed core of adjacent vertically stacked panels 50e-50n wrapped by an outer  
30 covering of perimetrically placed, alternating vertically and horizontally disposed panels 50a-50d. All panels 50, except panels 50b and 50d, have their corrugations oriented in the vertical direction.

The gussets 47 may be formed from blanks or cut from formed pieces of the base members 11". The folded cross-sectional configuration of the gussets 47 is the same as that of the deck members 11". End gussets 47a and 47c are formed with one angled edge 52 and one vertical end edge 53. Intermediate gussets 47b are formed with oppositely directed, downwardly-converging angled edges 52a, 52b. The gussets 47 are provided with downwardly-facing U-shaped notches 17" which are mated with the upwardly facing U-shaped notches 16a" formed in the base members 11". The vertical dimensions of members 11" and gussets 47 are equal, and the cuts 16a" and 17" are made so that the sum of the depths (vertical dimensions) of the notches 16a" and 17" will be equal to the vertical dimension of the members 11", 47. The height (vertical dimension) of the runners 46 is chosen to match the depths of the notches 16a" and 16b", so that the top surfaces of the runners 46 received within the notches 16a" and 16b" will be in the same plane as the top surfaces of the base members 11". The width (distance between opposite walls) of notches 16a" is chosen to be slightly less than the sum of the widths (horizontal dimension perpendicular to their elongations) of the runners 46 and gussets 47. The width of the notches 16b" is made slightly less than the width of the gussets 47. The dimensions and angling of the gussets 47 are chosen so that longitudinal channels 15" will be provided between the floor and the undersurface of the gussets 47 which are of approximately the same configuration as the channels 15 of pallet 10 (FIG. 1). The gussets 47 provide the floor contacting, weight supporting function of the portions 18 of members 12 of pallet 10; the runners 46 provide the lateral and diagonal stabilizing function of the portions 19 of member 12. The unbroken undersurfaces of runners 46 presented by the

horizontally extending panels 50b (see FIG. 10), provide an unbroken surface backup to the channels 15".

Another embodiment 100 of a pallet in accordance with the present invention is shown in FIG. 13. The pallet 100 comprises a plurality of base members or stringers 111 laid in parallel, spaced positions longitudinally of the pallet 110 and interconnected in criss-cross fashion by a plurality of elongated deck members or cross stringers 112 laid in parallel, spaced positions laterally of the pallet 110, to respectively perpendicularly intersect the members 11 at axially displaced positions therealong. The shown embodiment 110 utilizes four base members 111 and four decking members 112; though, of course, those numbers may be varied.

Pallet 110 represents an inexpensive, skid embodiment of the previously described pallet. The deck members 111 are constructed of corrugated cardboard, as already described above in connection with pallets 10, 10' and 10". Each member 11 may be formed from a blank, like blank 26 shown in FIG. 5, to provide a folded structure having a closely packed inner core of adjacent vertically stacked panels wrapped by an outer covering of perimetrically placed, alternating vertically and horizontally disposed panels, with the vertically stacked panels all having their corrugations oriented in the vertical direction. Upwardly-facing U-shaped notches 116, of width slightly less than the width of the member 111, may be formed either by die cutting of the blank 26 prior to folding and gluing, or by cutting the notches 116 into the already folded structure 111. If desired, the members 111 may be provided with optional tine channel cutouts 135 (shown in dot-dashed lines in FIG. 13), like the cutouts 35 already described, for the purpose of providing four-way fork tine access.

The deck members 112 may be inexpensively provided by utilizing folded members of the same cross-sectional configuration as used for members 111, except that the same are placed in horizontal, rather than vertical, orientation. The folded and glued packed structure of member 111 should provide sufficient support in the horizontal position for skid utilization purposes, even without vertical corrugation orientation or the additional ground support provided by the deck members 12, 12" of the described pallets 10, 10' and 10". Where more ruggedized construction is desired, a separate blank can be employed to produce a member 112 whose inner core panels are vertically stacked, with vertically oriented corrugations.

The members 112 have opposite horizontally outward-facing U-shaped notches 117, 118 which may be die cut prior to folding, or cut out after folding. A suitable die cut blank 126 for forming deck members 112 is shown in FIG. 15. The blank 126 may be similar to the blank 26 usable to form the base members 111, with the die cuts for forming the notches 118 corresponding to those used for forming the notches 116; however, with additional die cuts added to form the opposing notches 117. Dimensioning may be chosen between the members 111 and 112 so that commonality of manufacture of those members can be maximized. For example, the notches 116, 118 can be identically configured, with the only difference between the members 111, 112 being the additional notches 117 which can be added prior to folding or cut into already assembled members 112. The minimum horizontal extent (distance between the bases of notches 117, 118) of members 112 is selected to be slightly greater than the length (dimension in the direction of elongation of member 111) of the notches 116, to apply a force fit of the reduced portion 119 of member 112 into the notch 116. The

depth (vertical dimension) of notch 116 is chosen to match the width (vertical dimension) of member 112, so that the top surfaces of members 111, 112 of the assembled structure will lie in a common plane which can be covered by a top sheet 14, as with the other pallets.

Those skilled in the art to which the invention relates will appreciate that the foregoing detailed embodiments serve merely to illustrate exemplary implementations of the invention and that various substitutions and modifications may be made to the same, without departing from the spirit and scope of the present invention as defined by the claims appended hereto.

## CLAIMS

In the claims:

1. A pallet of corrugated material for the shipment and storage of a load of goods stacked thereon, and the  
5 like, comprising:
  - a plurality of spaced, parallel and longitudinally extending base members;
  - a plurality of spaced, parallel and longitudinally extending base members;
  - 10 a plurality of spaced, parallel and laterally extending deck members interconnecting said base members at longitudinally spaced intervals therealong;
  - wherein each base member comprises a first unitary blank of corrugated material, divided by first crease and  
15 score lines into first adjacent rectangular panels, and folded along said first crease and score lines to present a first closely packed core of adjacent vertically stacked ones of said first panels, wrapped by a first outer covering of perimetrically placed, alternating vertically  
20 and horizontally disposed ones of said first panels, said vertically stacked and vertically disposed first panels having their respective corrugations oriented vertically; and
  - each deck member comprises a second unitary blank of  
25 corrugated material, divided by second crease and score lines into second adjacent rectangular panels, and folded along said second crease and score lines to present a second closely packed core of adjacent stacked ones of said second panels, wrapped by a second outer covering of  
30 perimetrically placed, alternating vertically and horizontally disposed ones of said second panels, said vertically disposed panels having their respective corrugations oriented vertically.



2. A pallet as in Claim 1, wherein said adjacent stacked ones of said second panels of second closely packed core are horizontally stacked, and said horizontally stacked and horizontally disposed second panels have their respective corrugations oriented vertically.

3. A pallet as in Claim 2, wherein said second unitary blank comprises said first unitary blank, rotated by 90°.

4. A pallet as in Claim 1, wherein the base and deck members are interconnected at points of intersection by locking and linking joints, in which a protuberance or void of each base member mates in close tolerance with a complementary protuberance or void of each deck member.

5. A pallet as in Claim 4, wherein the base members are provided with upwardly-facing, U-shaped notches; the deck members are provided with opposite outwardly-facing, U-shaped notches forming reduced dimensioned portions; and second reduced dimension portions are mated with said upwardly-facing notches.

AMENDED CLAIMS

[received by the International Bureau on 7 April 1993 (07.04.93);  
original claims 2-5 cancelled; original claim 1 amended;  
new claims 6-27 added (8 pages)]

1. A pallet of corrugated material for the shipment  
and storage of a load of goods stacked thereon, and the  
5 like, comprising:  
a plurality of laterally-spaced, parallel and  
longitudinally extending base members; and  
a plurality of longitudinally-spaced, parallel and  
laterally extending deck members;  
10 wherein each base member is a rectangular cross-  
sectioned member having a planar top surface, and  
comprises a first unitary blank of corrugated material,  
divided by first crease and score lines into first  
adjacent rectangular panels, and folded along said first  
15 crease and score lines to present a first closely packed  
core of adjacent stacked ones of said first panels,  
wrapped by a first outer covering of perimetrically  
placed, alternating vertically and horizontally disposed  
ones of said first panels;  
20 each deck member is a rectangular cross-sectioned  
member having a planar top surface and comprises a second  
unitary blank of corrugated material, divided by second  
crease and score lines into second adjacent rectangular  
panels, and folded along said second crease and score  
25 lines to present a second closely packed core of adjacent  
stacked ones of said second panels, wrapped by a second  
outer covering of perimetrically placed, alternating  
vertically and horizontally disposed ones of said second  
panels;  
30 each base member being further provided with a  
plurality of longitudinally-spaced, parallel and laterally  
extending U-shaped notches which open upwardly onto said  
each base member top surface; said deck members being  
respectively inserted, at laterally-spaced places along

said deck members, into corresponding ones of said notches of said base members to establish the longitudinal spacing of said deck members; and said notches being longitudinally dimensioned less than corresponding longitudinal dimensions, at said places of insertion, of  
5 said deck members by an amount sufficient to apply an interference force fit for interconnecting said base members by said deck members to establish the lateral spacing of said base members.

10 6. A pallet as in claim 1, wherein said notches are vertically dimensioned relatively the same as corresponding vertical dimensions, at said places of insertion, of said deck members so that said deck members fully inserted into said notches present said deck member  
15 top surfaces in a common plane with said base member top surfaces.

7. A pallet as in claim 1, wherein said adjacent stacked ones of said first panels of said first closely packed core are vertically stacked, and said adjacent  
20 stacked ones of said second panels of said second closely packed core are horizontally stacked.

8. A pallet as in claim 1, wherein said adjacent stacked ones of said first panels of said first closely packed core are vertically stacked, and said vertically  
25 stacked and vertically disposed first panels have their respective corrugations oriented vertically.

9. A pallet as in claim 1, wherein said vertically disposed second panels have their respective corrugations oriented vertically.

30 10. A pallet of corrugated material for the shipment and storage of a load of goods stacked thereon, and the like, comprising:

a plurality of spaced, parallel and longitudinally extending base members;

a plurality of spaced, parallel and laterally extending deck members;

wherein each base member is a rectangular cross-sectioned member having a planar top surface and comprises  
5 a plurality of first panels of corrugated material, arranged to present a first closely packed core of adjacent vertically stacked ones of said first panels, wrapped by a first outer covering of perimetrically placed, alternating vertically and horizontally disposed  
10 ones of said first panels; and

each deck member is a rectangular cross-sectioned member having a planar top surface and comprises a plurality of second panels of corrugated material, arranged to present a second closely packed core of  
15 adjacent stacked ones of said second panels, wrapped by a second outer covering of perimetrically placed, alternating vertically and horizontally disposed ones of said second panels;

each base member being further provided with a  
20 plurality of longitudinally-spaced, parallel and laterally extending U-shaped notches which open upwardly onto said each base member top surface; said deck members being respectively inserted, at laterally-spaced places along said deck members, into corresponding ones of said notches  
25 of said base members to establish the longitudinal spacing of said deck members; said notches being longitudinally dimensioned less than corresponding longitudinal dimensions, at said places of insertion, of said deck members by an amount sufficient to apply an interference  
30 force fit for interconnecting said base members by said deck members to establish the lateral spacing of said base members; and said notches being vertically dimensioned relatively the same as corresponding vertical dimensions, at said places of insertion, of said deck members so that

said deck members inserted into said notches present said deck member top surfaces in a common plane with said base member top surfaces.

11. A pallet of corrugated material for the shipment  
5 and storage of a load of goods stacked thereon, and the like, comprising:

a plurality of spaced, parallel and longitudinally  
extending base members;

a plurality of spaced, parallel and laterally  
10 extending deck members;

wherein each base member is a rectangular cross-  
sectioned member having a planar top surface and comprises  
a first unitary blank of corrugated material, divided by  
first crease and score lines into first adjacent  
15 rectangular panels, and folded along said first crease and  
score lines to present a first closely packed core of  
adjacent vertically stacked ones of said first panels,  
wrapped by a first outer covering of perimetrically  
placed, alternating vertically and horizontally disposed  
20 ones of said first panels, said vertically stacked and  
vertically disposed first panels having their respective  
corrugations oriented vertically; and

each deck member is a rectangular cross-sectioned  
member having a planar top surface and comprises a second  
25 unitary blank of corrugated material, divided by second  
crease and score lines into second adjacent rectangular  
panels, and folded along said second crease and score  
lines to present a second closely packed core of adjacent  
horizontally stacked ones of said second panels, wrapped  
30 by a second outer covering of perimetrically placed,  
alternating vertically and horizontally disposed ones of  
said second panels, said horizontally stacked and  
horizontally disposed second panels having their  
respective corrugations oriented vertically;

each base member being further provided with a plurality of longitudinally-spaced, parallel and laterally extending first U-shaped notches which open upwardly onto said each base member top surface; each deck member having  
5 opposing vertical sides and being further provided with a plurality of laterally-spaced, parallel and vertically extending opposing pairs of second U-shaped notches, one notch of each pair opening to one vertical side and the other notch of each pair opening to the other vertical  
10 side; said deck members being respectively inserted at said pairs of second notches into corresponding ones of said first notches to establish the longitudinal spacing of said deck members; said first notches being longitudinally dimensioned less than spacings between ones  
15 of said pairs of said second notches by an amount sufficient to apply an interference force fit for interconnecting said base members by said deck members to establish the lateral spacing of said base members; and said first notches being vertically dimensioned relatively  
20 the same as corresponding vertical dimensions, between said ones of said pairs of first notches, of said deck members, so that said deck members inserted into said first notches present said deck member top surfaces in a common plane with said base member top surfaces.

25 12. A pallet of corrugated material for the shipment and storage of a load of goods stacked thereon, comprising:

a plurality of elongated base members laid longitudinally in parallel, spaced positions; and  
30 a plurality of elongated deck members laid laterally in parallel, spaced, positions and intersecting said base members at longitudinally displaced positions therealong to interconnect the same to form a free standing lattice structure;

said base and deck members each having top surfaces located in a common upper horizontal plane to provide a level upper platform, and bottom surfaces located in a common lower horizontal plane to provide a stable, floor-contacting base; wherein each of said base and deck  
5 members is formed from a single sheet of folded corrugated material, and each comprises a solid core of adjacent vertically oriented panels surrounded by an outer covering of parametric horizontal and vertically running panels.

10 13. The pallet defined in claim 12, wherein at least one of said plurality of deck members has cutouts therein to present channels perpendicular to said base member into which the tines of pallet lifting equipment can be inserted; and each of said base members being formed with  
15 first and second portions, said cutouts being in said first portions and defining lifting surfaces against which the tines inserted in said channels can act to lift said pallet, and said second portions being located adjacent to said first portions and defining backup surfaces of uncut  
20 corrugated material in alignment with said cutout lifting surfaces against which said tines can also act when they act against the cutout lifting surfaces during lifting of said pallet.

25 14. The pallet defined in claim 13, wherein at least one of said plurality of base members is provided with a series of cutouts to form laterally aligned tine receiving openings.

30 15. The pallet defined in claim 14, wherein each said base member having said laterally aligned tine receiving openings also has a first and second portion, said laterally aligned tine receiving openings being formed in said first portions and defining lifting surfaces against which the tines inserted in said channels can act to lift said pallet; and said second portions

being located adjacent to said first portions and defining backup surfaces of uncut corrugated material in alignment with said laterally aligned tine receiving openings against which said tines can also act when they act  
5 against the cutout lifting surfaces during lifting of said pallet.

16. The pallet defined in claim 15, wherein the laterally aligned tine receiving openings of said base member are of a smaller depth than said cutouts of said  
10 deck members, and said second portion of said base member is of a smaller width than the second portion of said deck member.

17. The pallet defined in claim 12, wherein said deck members are square cross-sectioned runners, and the  
15 bottom surfaces of said deck members and said base members are no longer in a common lower horizontal plane.

18. The pallet defined in claim 12, wherein each of said deck members are of a multiple piece construction including, in addition to said square cross-sectioned  
20 runner, a plurality of aligned, laterally spaced gussets, the bottom surfaces of said gussets being in a common horizontal plane.

19. The pallet defined in claim 12, wherein each of said elongated base members includes a plurality of  
25 upwardly facing U-shaped rectangular notches, and each of said deck members include a plurality of opposite, horizontally outward facing, U-shaped notches for engagement with said upwardly facing U-shaped rectangular notches, the upwardly facing U-shaped rectangular notches  
30 of said base members being in mating engagement with said plurality of opposite horizontally outward facing U-shaped notches to form a weight supporting lattice structure wherein said base members and said deck members form a



common upper horizontal plane to provide a level upper platform.

20. The pallet defined in claim 12, and including a top sheet attached to said pallet.

5        21. The pallet defined in claim 13, and including a top sheet attached to said pallet.

22. The pallet defined in claim 14, and including a top sheet attached to said pallet.

10       23. The pallet defined in claim 15, and including a top sheet attached to said pallet.

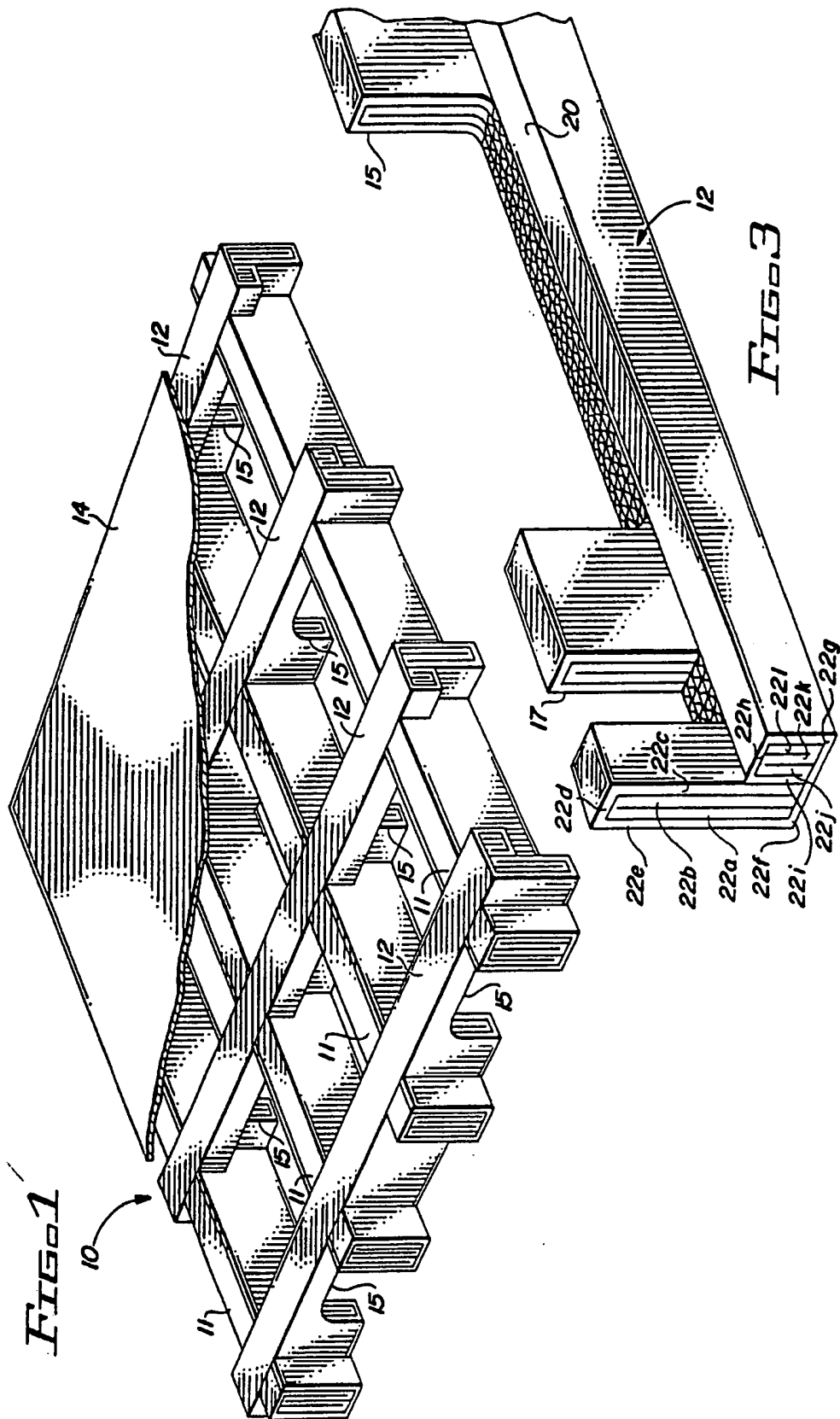
24. The pallet defined in claim 16, and including a top sheet attached to said pallet.

25. The pallet defined in claim 17, and including a top sheet attached to said pallet.

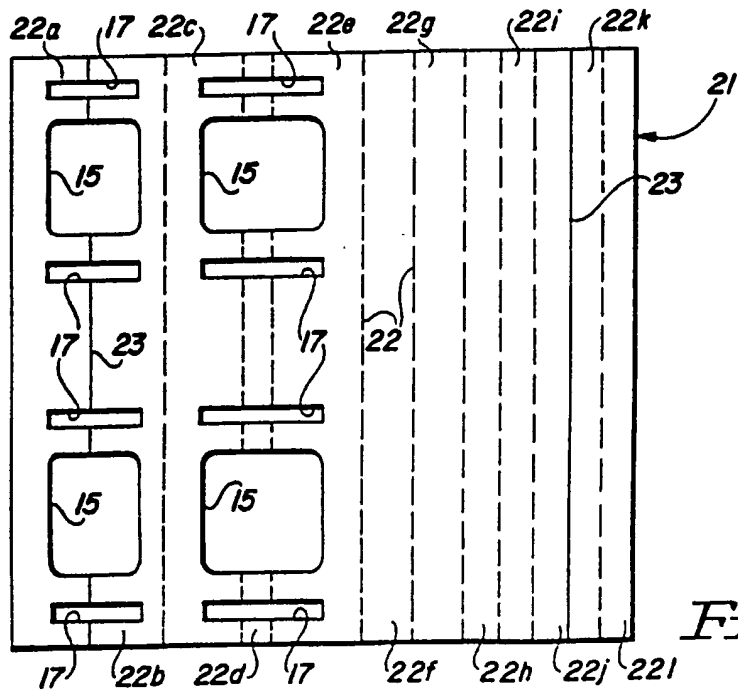
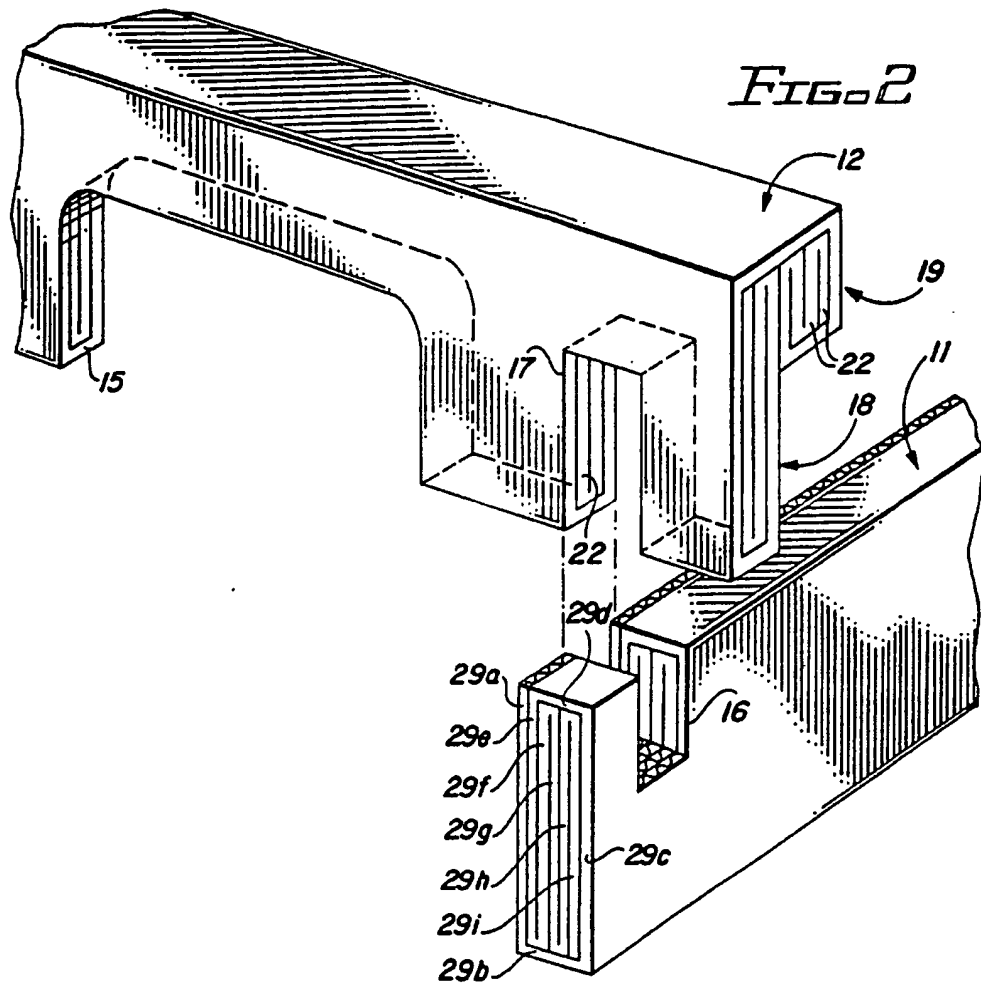
15       26. The pallet defined in claim 18, and including a top sheet attached to said pallet.

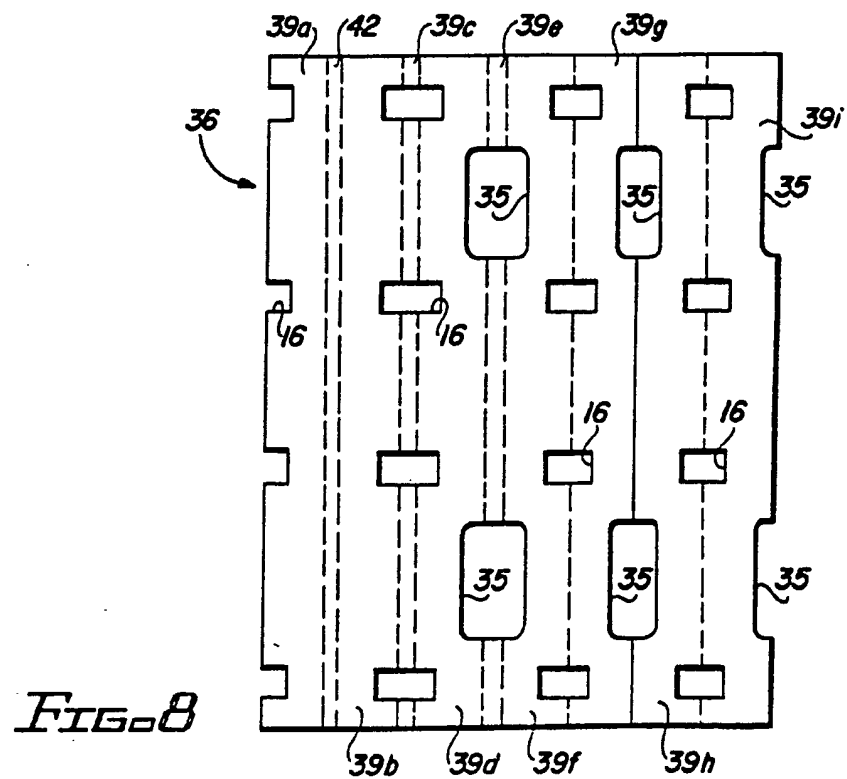
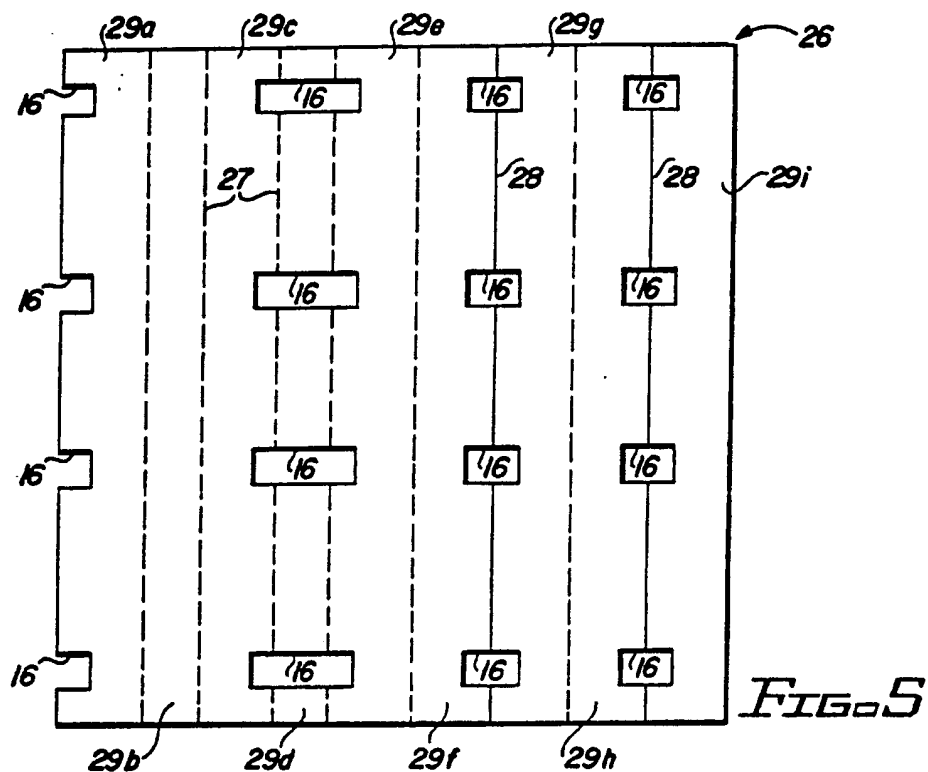
27. The pallet defined in claim 19, and including a top sheet attached to said pallet.

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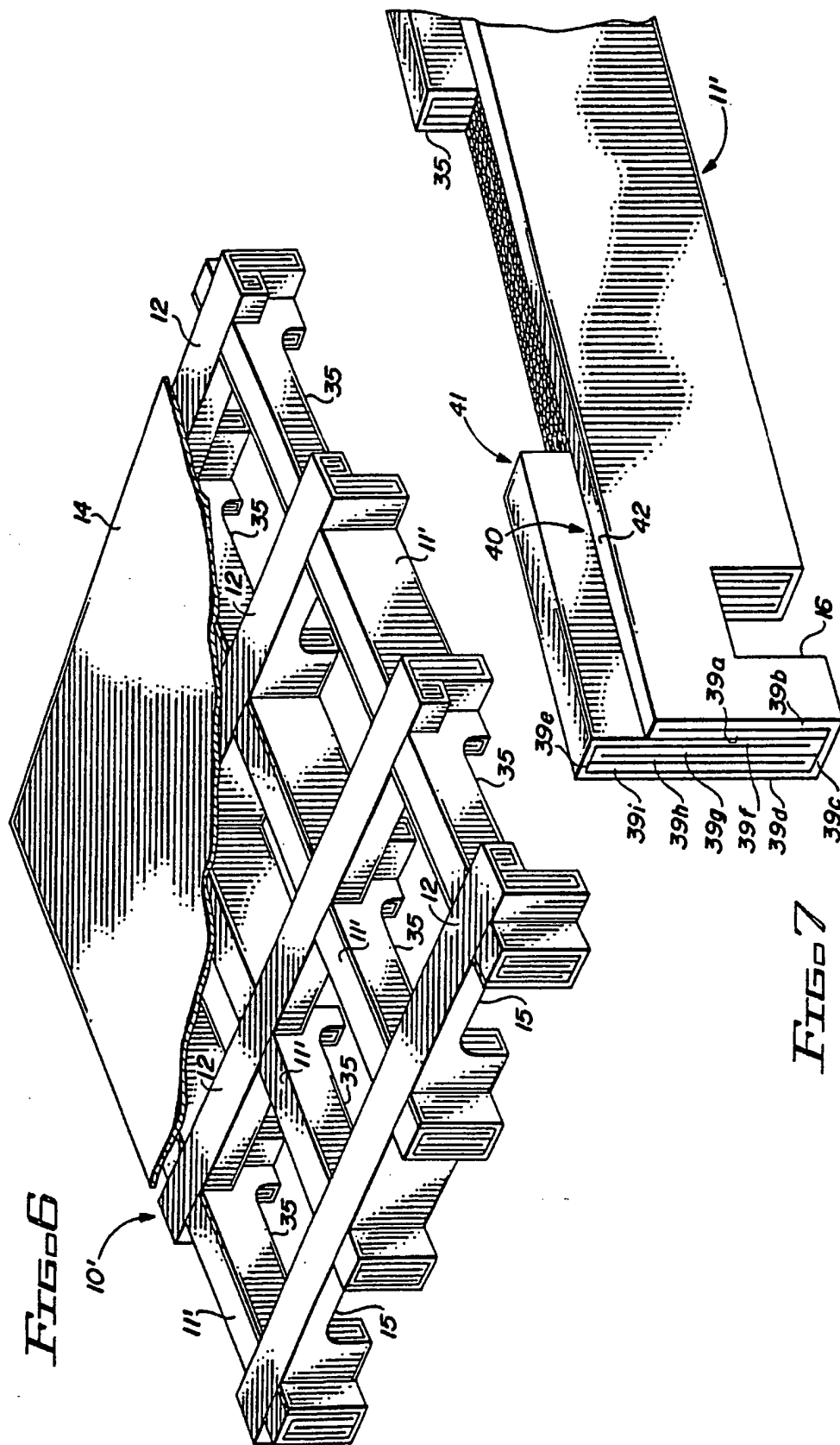


FIG. 6

FIG. 7

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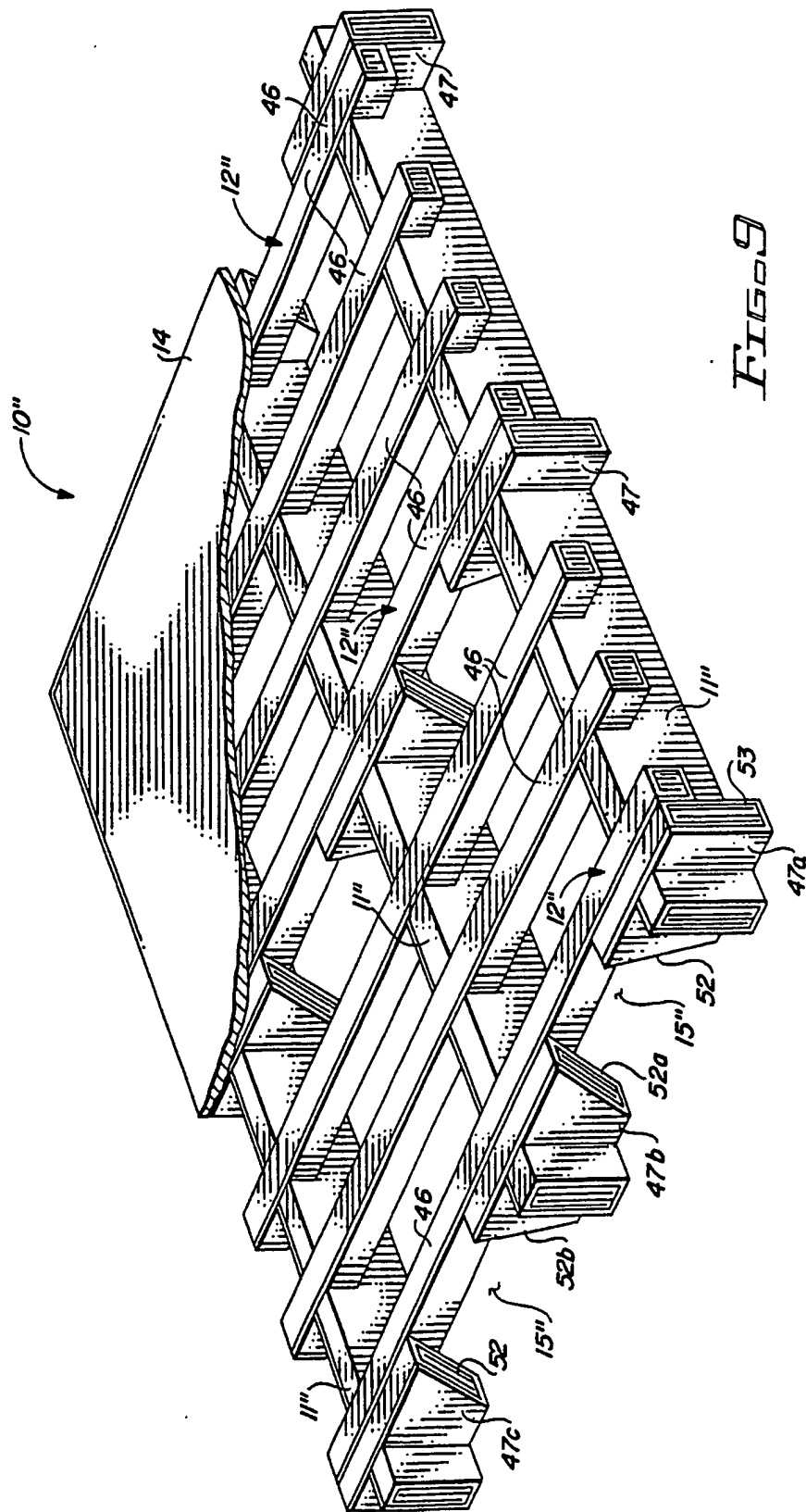


FIG. 9

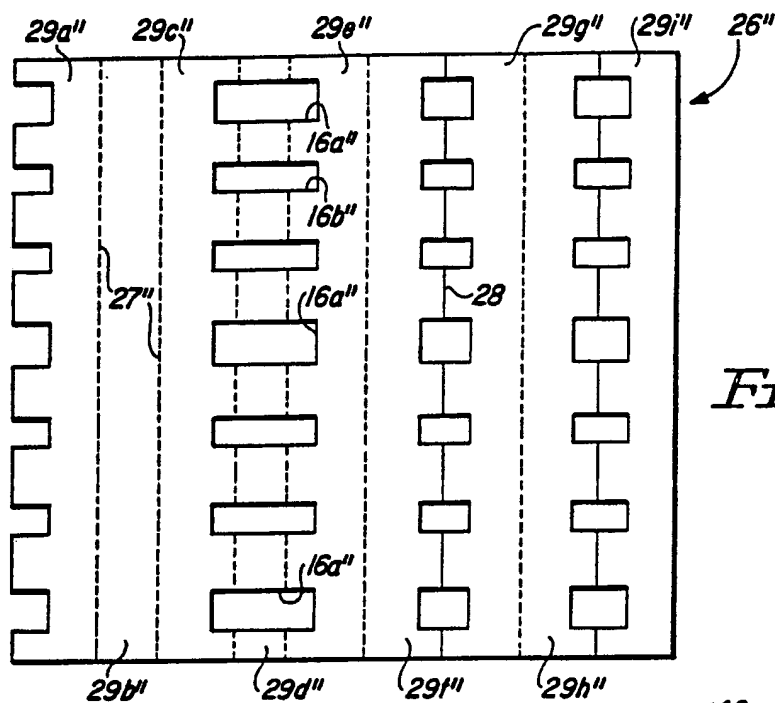


FIG. 12

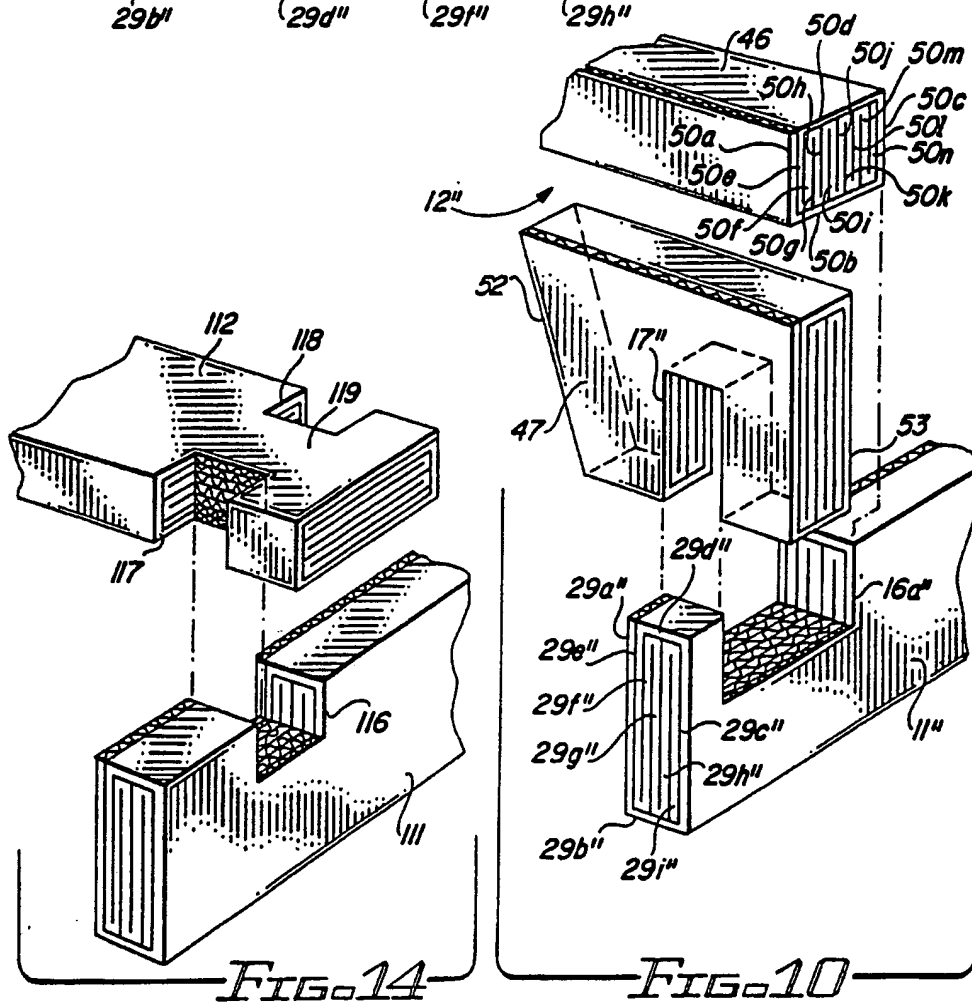


FIG. 14

FIG. 10

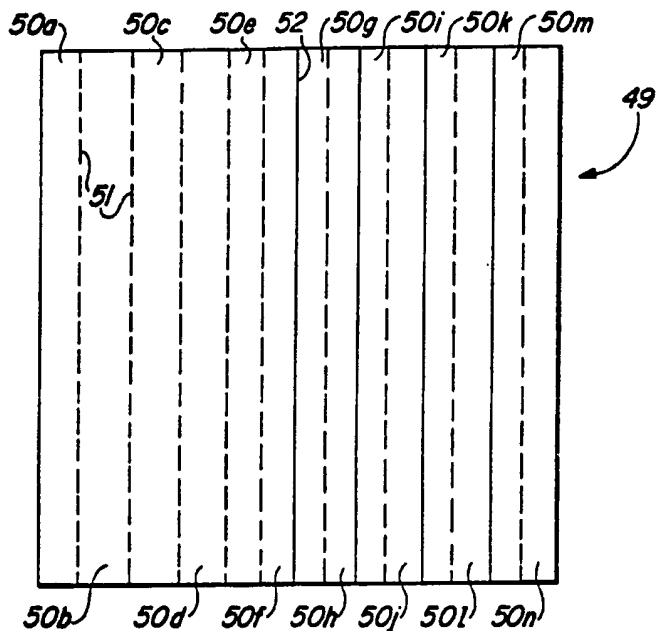


FIG. 11

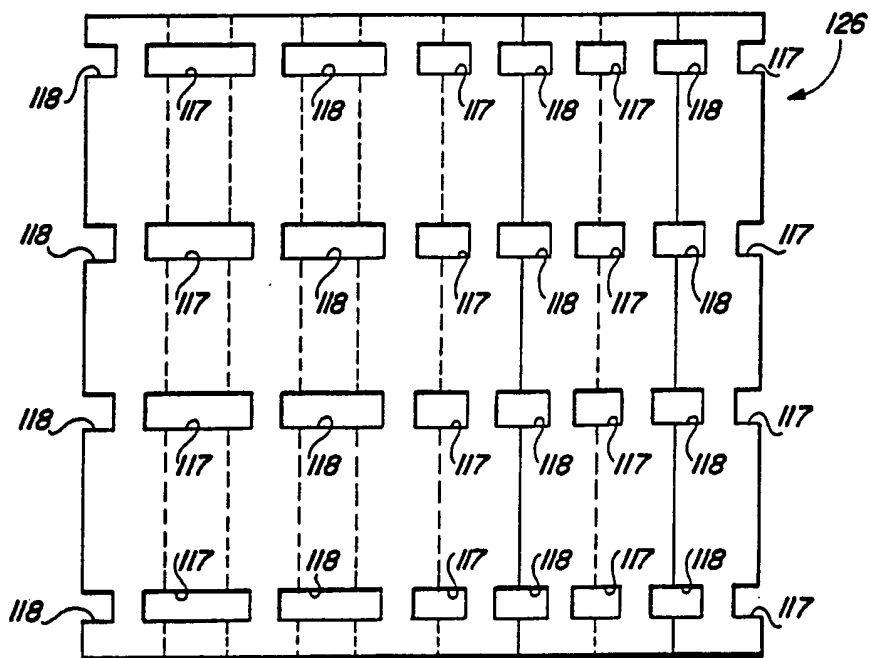
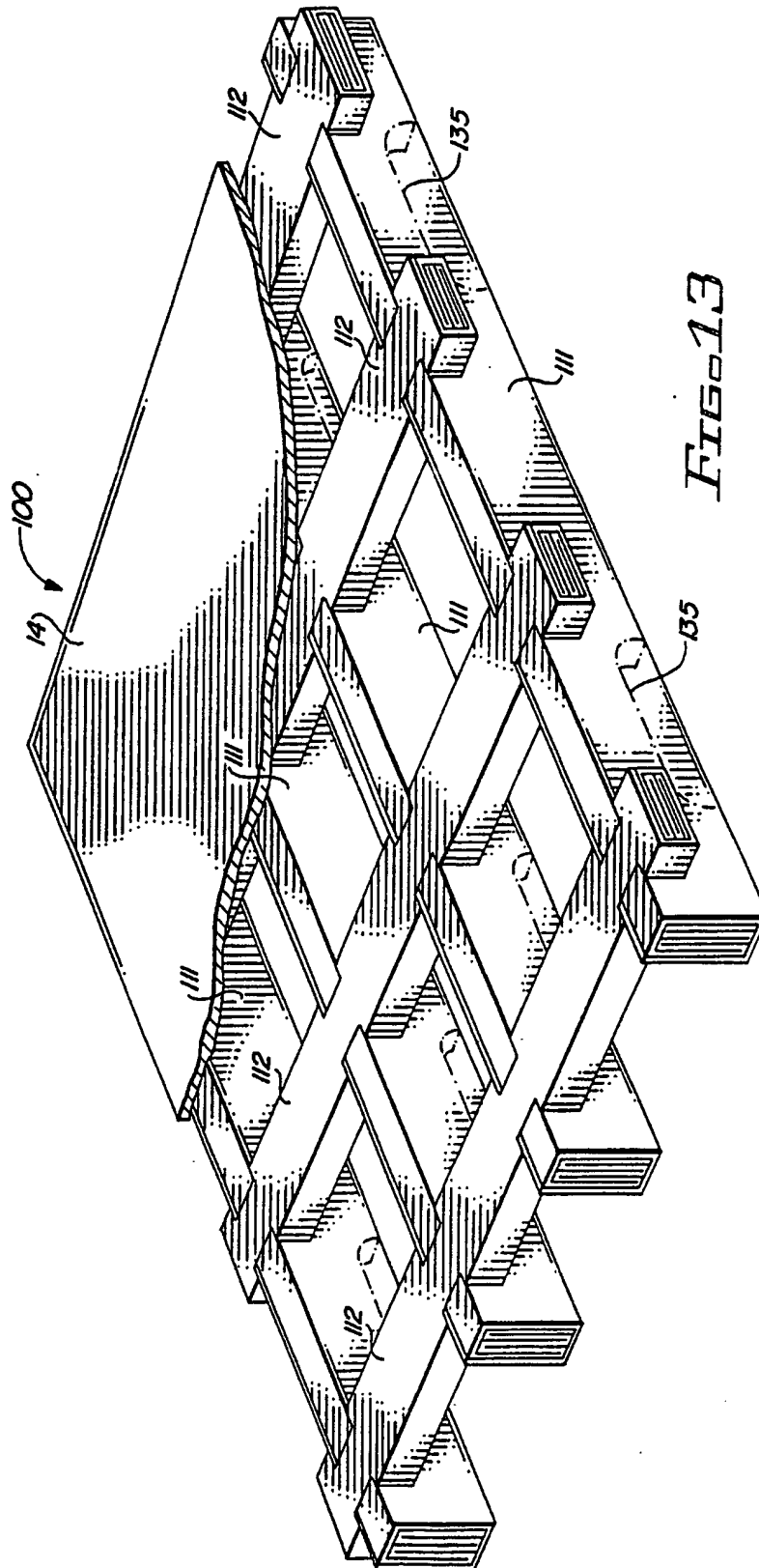


FIG. 15



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## INTERNATIONAL SEARCH REPORT

PCT/US92/09928

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :B65D 19/00

US CL :108/51.3,56.1

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 108/51.3,56.1 108/51.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A, 2,287,740 (Klouman) 23 June 1942 See the entire document.	
A	US,A, 2,709,559 (Geisler) 31 May 1955 See the entire document.	
A	US,A, 3,026,078 (Simkins) 20 March 1962 See the entire document.	
A	US,A, 3,256,839 (Peterson et al.) 21 June 1966 See the entire document.	
Y	US,A, 3,940,101 (Heidelbach) 24 February 1976 See the entire document.	1-5

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be part of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Z" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

25 FEBRUARY 1993

Date of mailing of the international search report

16 MAR 1993

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US92/09928

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A, 4,077,334 (Svirklys) 07 March 1978 See the entire document.	1-5
A	US,A, 4,359,948 (Judy et al.) 23 November 1982 See the entire document.	
Y	US,A, 4,841,880 (Ferguson) 27 June 1989 See the entire document.	
A	US,A, 4,867,074 (Quasnick) 19 September 1989 See the entire document.	